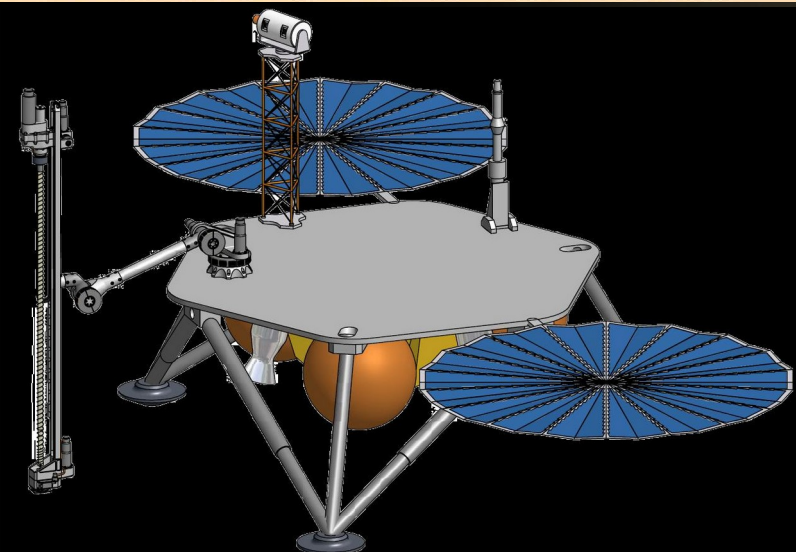


Mars IceBreaker Drill

Mars IceBreaker is the NASA ASTEP/ASTID funded project to develop a 1 m drill for sampling ice and icy-soil on Mars. Dry Valleys is an ideal Mars analog site for the IceBreaker testing because of low temperature and formation type: ice-cemented ground and massive ice.

The Mars IceBreaker mission returns to the ice-rich Phoenix landing site in the Northern plains to drill into the ground ice and analyze samples to a depth of 1 meter, search for life and organics, assess habitability, and study recent climate and liquid water activity.



Mars IceBreaker lander with a 1 m sampling drill



1 meter in ice cemented ground + ~90% sample recovery

- Full drill autonomy
- Avg. Power ~ 100 Watt (at 1 m)
- Penetration Rate ~ 0.7 m/hr
- Weight on Bit < 100 Newton
- Bit Temperature ~ -5°C (Ice Temperature ~ -19°C)



2.5 meter in ice + ~95% sample recovery

- Full drill autonomy
- Avg. Power ~ 120 Watt (at 2.5 m)
- Penetration Rate ~ 1 m/hr
- Weight on Bit < 100 Newton
- Bit Temperature ~ -13°C (Ice Temperature ~ -24°C)



Cuttings include ice crystals ~0.25" in size



Sampling Station

Cuttings of ice, ice-cemented ground, soil, and rock are augered to the surface and brushed off into a sterile sample bag.



The Team

NASA Ames

Chris McKay (PI, ASTEP)

Brian Glass (PI, ASTID)

Alfonso Davila

Jennifer Heldmann

Margarita Marinova

Honeybee Robotics

Kris Zacny

Gale Paulsen

Mc Gill University

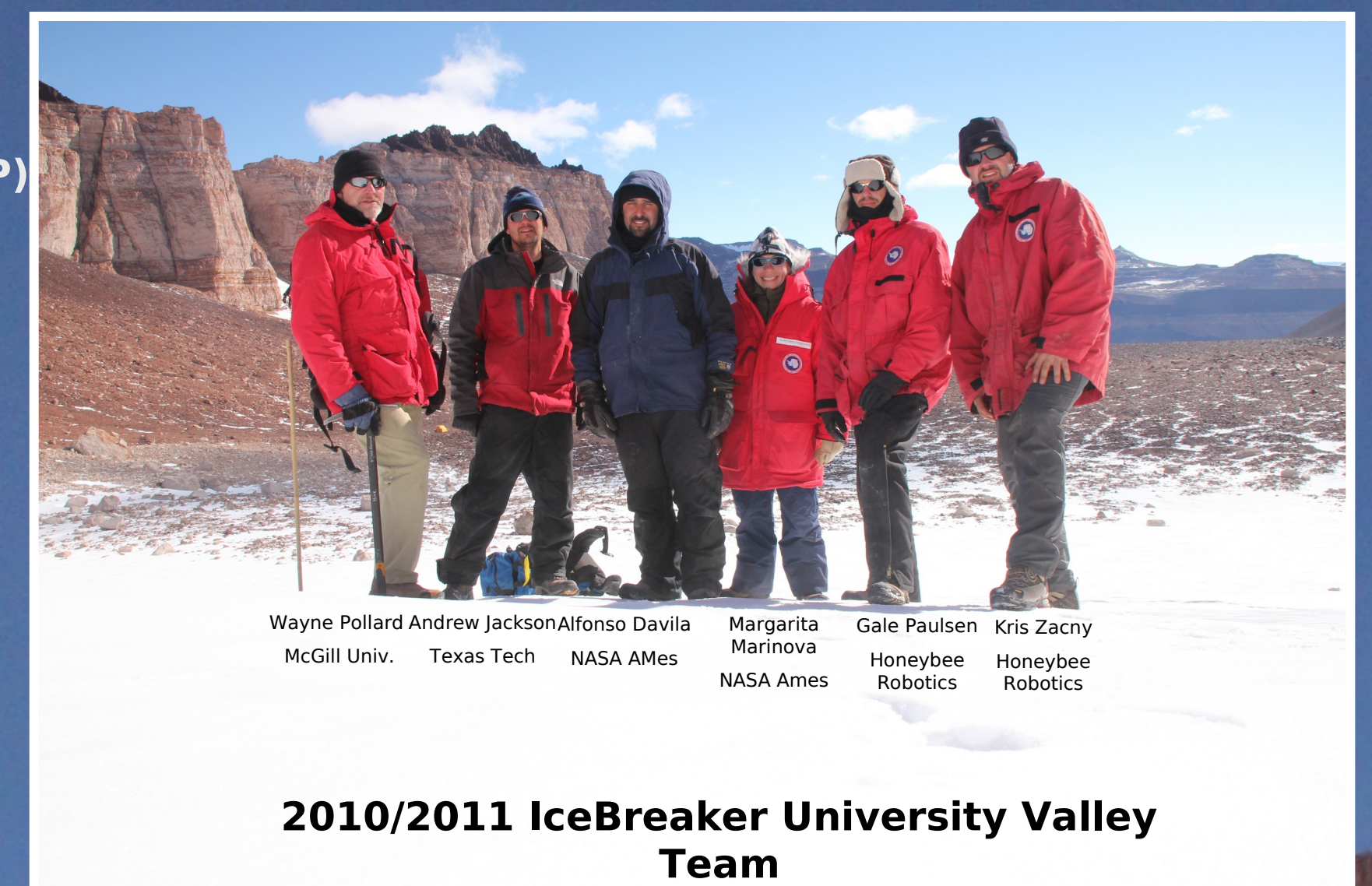
Wayne Pollard

SETI

Dale Andersen

University of Ottawa

Denis Lacelae

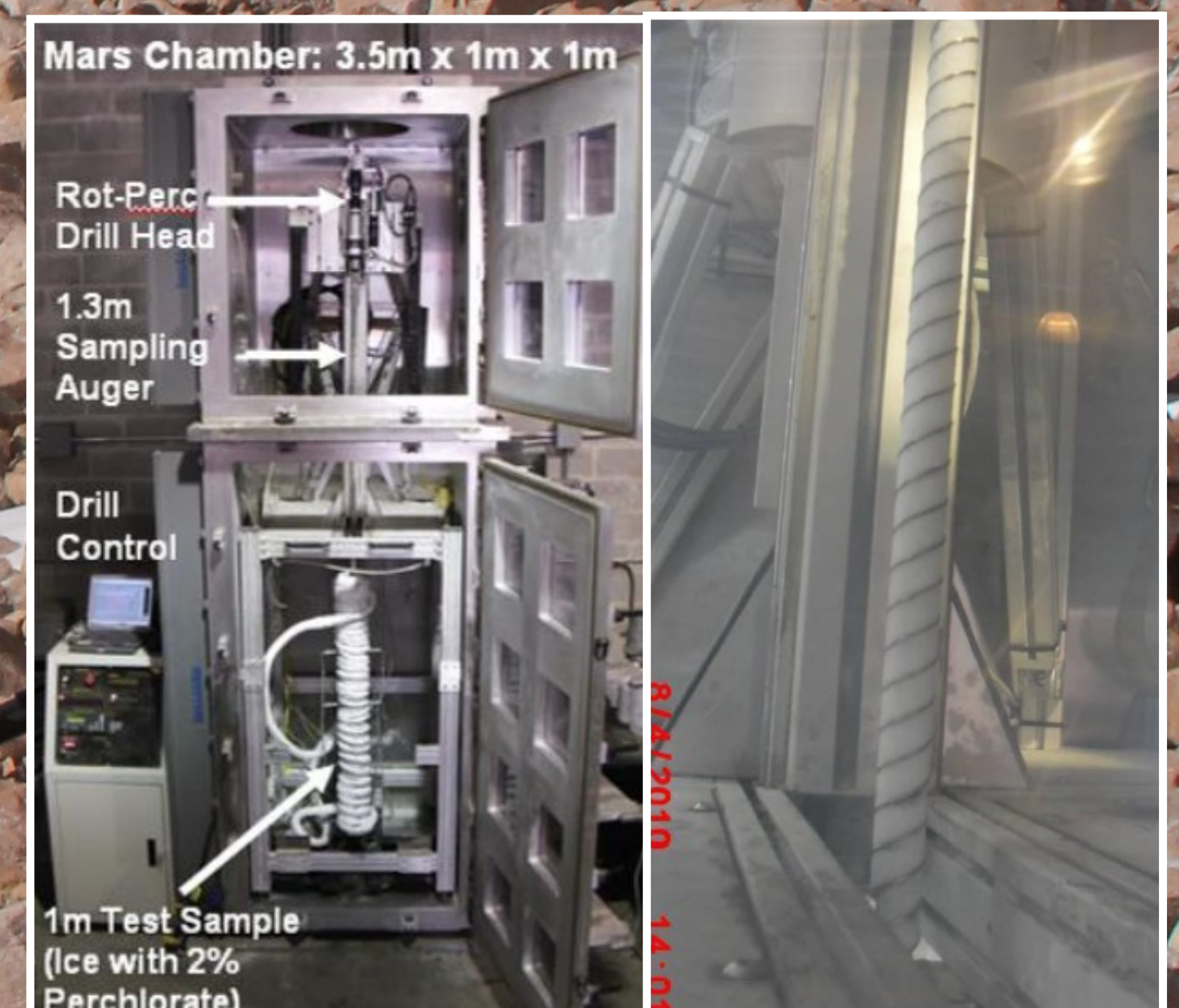


2010/2011 IceBreaker University Valley Team



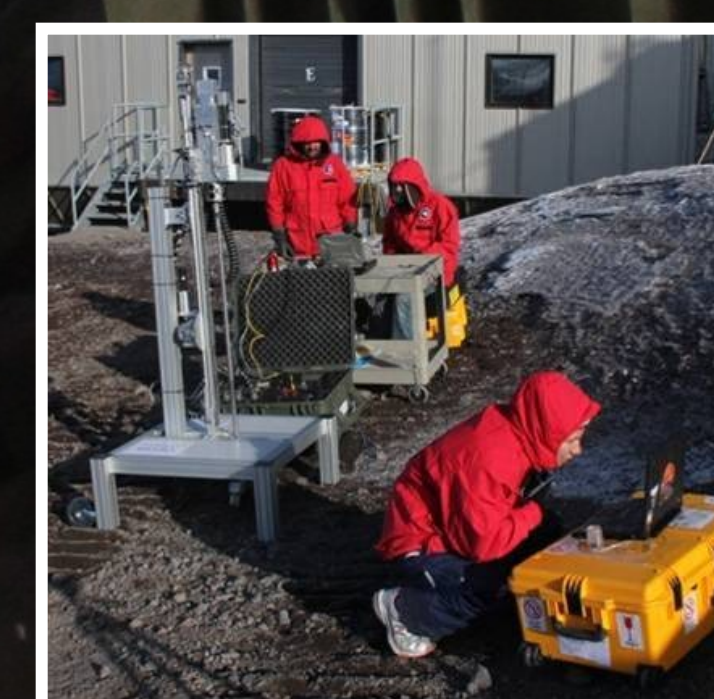
1 meter in ice cemented volcanic tephra + ~90% sample recovery

- Full drill autonomy
- Avg. Power ~ 100 Watt (at 1 m)
- Penetration Rate ~ 0.7 m/hr
- Weight on Bit < 100 Newton
- Bit Temperature ~ -1°C (Ice Temperature ~ -10°C)
- Drill on a 11° slope



1 meter tests in Mars Chamber

- Full drill autonomy
- Atmospheric Pressure ~ 6.4 torr (Mars Pressure)
- Sample Temperature ~ -20° C and -80° C
- Avg. Power ~ 100 Watt (at 1 m)
- Penetration Rate ~ 1 m/hr
- Weight on Bit < 100 Newton
- Bit Temperature ~ -18° C and -75° C (Ice at ~ -20° C and -80° C)



Remote Operations

The IceBreaker drill was teleoperated by 5th graders from Valley View School, Pleasanton, CA.